U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: TYPE CERTIFICATION OF OXYGENATES AND OXYGENATED GASOLINE FUELS IN PART 23 AIRPLANES WITH RECIPROCATING ENGINES

Date: 4/24/96
Initiated by: ACE-100

AC No: 23.1521-2
Change: 1

1. PURPOSE. This change transmits revised pages for the subject advisory circular (AC).

2. EXPLANATION OF CHANGE. This change has been initiated to clarify the Scope and to make the Scope and Purpose of this AC consistent with AC 23.1521-1B, Type Certification of Automobile Gasoline in Part 23 Airplanes with Reciprocating Engines. The asterisks (*) in the right and left margins indicate the beginning and end of the change.

3. DISPOSITION OF TRANSMITTAL. After filing the revised page, this change transmittal should be retained.

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1. PURPOSE. This advisory circular (AC) provides information and guidance concerning an acceptable means, but not the only means, of * compliance with part 23 of the Federal Aviation Regulations (FAR), applicable to approval procedures for certification of alternate fuels. These procedures also apply to those airplanes approved/certificated under previous regulations superseded by part 23. This material is * neither mandatory nor regulatory in nature and does not constitute a regulation.

2. RELATED FAR SECTIONS. Sections 21.93(b), 23.23, 23.901(e), 23.903(a)(l), 23.903(f), 23.909, 23.951, 23.954, 23.955, 23.959, 23.961, 23.1041, 23.1093, 23.1521(d), 23.1541, and 23.1581.

3. RELATED READING MATERIAL. Related advisory circulars and other reading material are listed in appendixes 1 and 2, respectively.

4. SCOPE.

a. Fuels covered by this AC include oxygenates and oxygenated gasolines. This includes methyl-tertiary-butyl ether (MTBE), methanol, ethanol, other oxygenates, and gasolines containing these or other * oxyqenates, except for automobile gasoline including those containing 11 percent or less alcohol by volume. Currently, gasolines are manufactured * to at least three different specifications available from the American Society for Testing and Materials (ASTM). These specifications are ASTM D 910 for aviation gasoline and D 439 and D 4814 for automobile gasoline. D 4814 supersedes D 439. ASTM D 4814 is intended to describe both * straight gasoline and gasoline-oxygenate blends. Guidance for certification of automobile gasoline including those containing 11 percent or less alcohol by volume is contained in AC 23.1521-18, Type Certification of Automobile Gasoline in Part 23 Airplanes with Reciprocating Engines or later revision. *

b. Section 23.1521(d) requires the minimum fuel grade be established so that it is not less than that required for the operation of the engine. The Type Certificate Data Sheet (TCDS) for the engine specifies fuel(s) that has (have) been substantiated during type certification of the engine. The fuel must have a documented specification to define the fuel properties.

c. The product produced by mixing of alternate fuels is considered a new alternate fuel and requires a separate approval for

use. Therefore, mixing of alternate fuels is prohibited unless the mixture is separately certified and the mixture documented by approved fuel specification. The alternate fuel specification should include the fuel properties (including visibility of flame), composition specification, and composition limits. An alternate fuel should be compatible with 100LL aviation gasoline and/or other fuels approved for use in the airplane.

5. BACKGROUND.

a. It is necessary to evaluate each engine and airplane model for compliance with the applicable FAR and determine that it is safe for operation. Therefore, a Supplemental Type Certificate (STC) or Type Certification (TC) is required for each different series or sub-series of engine and airplane models, for which approval is requested. An STC or TC is issued to an applicant who demonstrates to the FAA that the airplane meets the applicable regulations. The STC does not automatically apply to other airplanes. The STC or TC data developed by the applicant including drawings, reports, etc., are proprietary. A person wanting to operate an airplane on alternate fuel may either obtain an STC, if one is available, from the STC owner and comply with the STC requirements or the person may request certification from the appropriate FAA certification office and develop the data required for certification.

b. Applicants have applied for STC's to allow for the use of fuels other than aviation gasoline in part 23 reciprocating engine airplanes. The FAA Technical Center conducted a study to determine the conditions that are most likely to result in operational problems, should fuels other than aviation gasoline be used in general aviation reciprocating engine airplanes. The fuels studied range from automotive gasolines to automotive and aviation gasolines containing alcohol to straight alcohol fuels. The reports are included in the related reading material.

6. CERTIFICATION PROCEDURES.

a. It is mandatory that the engine (including turbocharger/intercoolers) and engine/propeller combination be approved for operation on the alternate fuel before it is eligible for approval in the airplane. Operation of the engine with any alternate fuel should be shown to meet the minimum design requirements for the engine and be approved. Advisory Circular 20-24B, "Qualification of Fuel, Lubricants, and Additives for Aircraft Engines, dated December 20, 1985, describes an acceptable method of obtaining approval for the engine to operate on alternate fuel. It may be possible for testing of the engine and airplane to be conducted concurrently.

b. The fuel for which approval is requested must be documented by a specification that is written in sufficient detail to provide at least the composition, physical properties, and limits by which uniform quality and composition can be maintained. The applicant is

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